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Kim et al.

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(54) **CONTENT RELAYING SCHEME**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

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H04N 21/266	(2011.01)
H04N 21/61	(2011.01)
H04N 21/643	(2011.01)
H04N 21/4363	(2011.01)
H04N 21/6405	(2011.01)
H04N 21/647	(2011.01)
H04H 20/02	(2008.01)
H04H 20/38	(2008.01)
H04H 60/85	(2008.01)
H04H 60/88	(2008.01)
H04L 29/06	(2006.01)
H04W 12/06	(2009.01)
H04H 20/82	(2008.01)

(52) **U.S. Cl.**

CPC ***H04N 21/6175*** (2013.01); ***H04H 20/02*** (2013.01); ***H04H 20/38*** (2013.01); ***H04H 60/85*** (2013.01); ***H04H 60/88*** (2013.01); ***H04L 65/4076*** (2013.01); ***H04L 65/604*** (2013.01); ***H04N 21/25816*** (2013.01); ***H04N 21/43637*** (2013.01); ***H04N 21/6125*** (2013.01); ***H04N 21/6405*** (2013.01); ***H04N 21/64322*** (2013.01); ***H04N 21/64707*** (2013.01); ***H04W 12/06*** (2013.01); *H04H 20/82* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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(57) **ABSTRACT**

In one example embodiment, a system includes an internet protocol television server configured to transmit a first-internet protocol multicast stream of internet protocol television content; a wireless router configured to: receive, from the internet protocol television server, the first-internet protocol multicast stream, convert the first-internet protocol multicast stream into a second-internet protocol unicast stream, and transmit the second-internet protocol unicast stream via a wireless network; and an end device configured to: transmit a request for the internet protocol television content to the wireless router, and receive the second-internet protocol unicast stream from the wireless router.

11 Claims, 6 Drawing Sheets

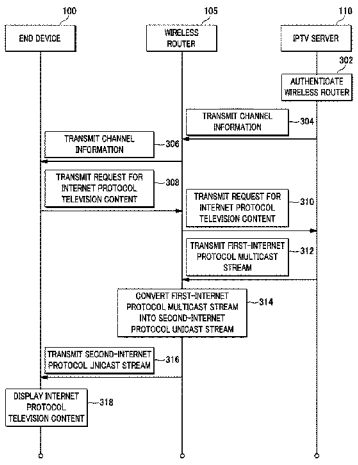


FIG. 1

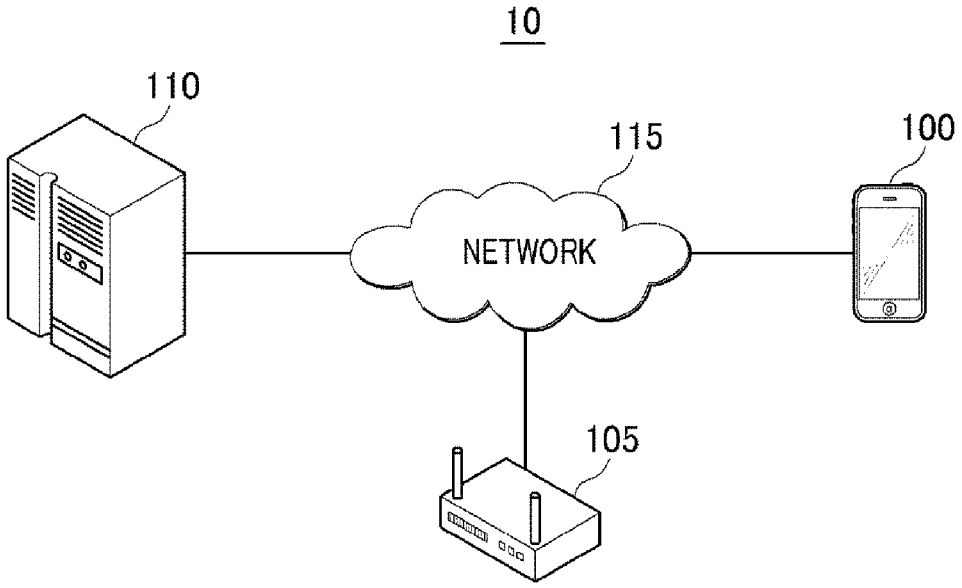


FIG. 2

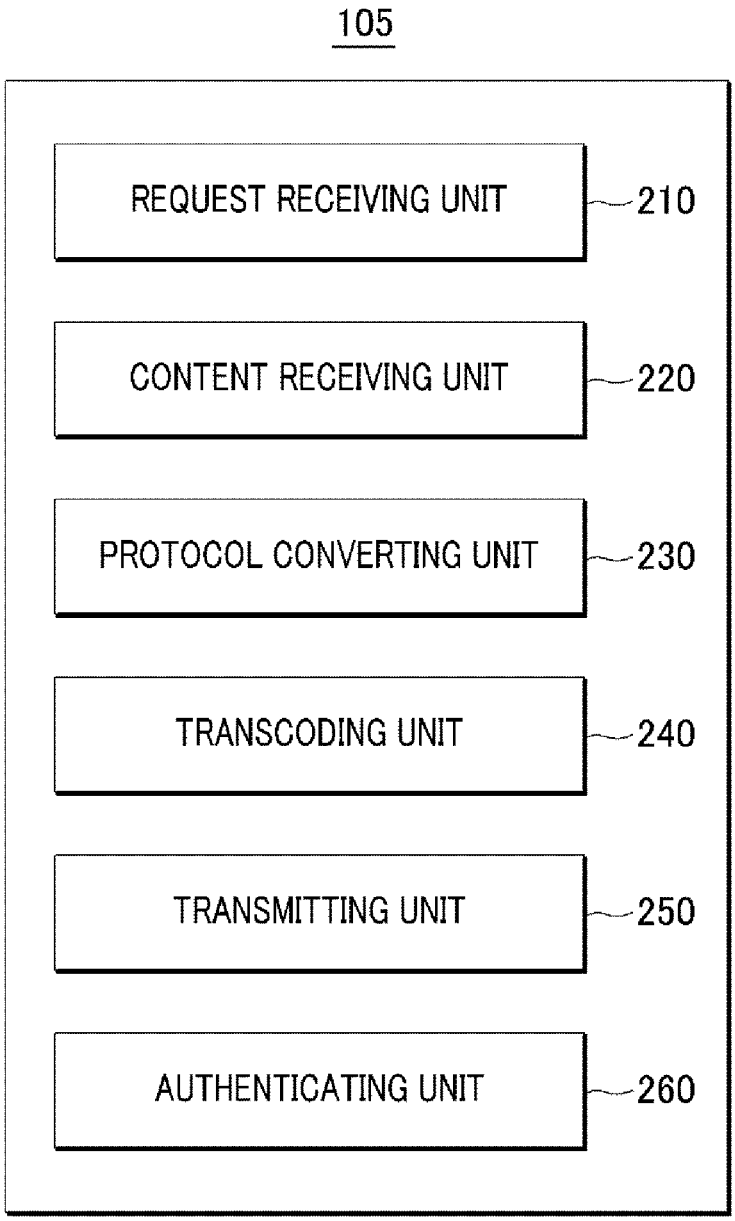

105
REQUEST RECEIVING UNIT
210
CONTENT RECEIVING UNIT
220
PROTOCOL CONVERTING UNIT
230
TRANSCODING UNIT
240
TRANSMITTING UNIT
250
AUTHENTICATING UNIT
260

FIG. 3

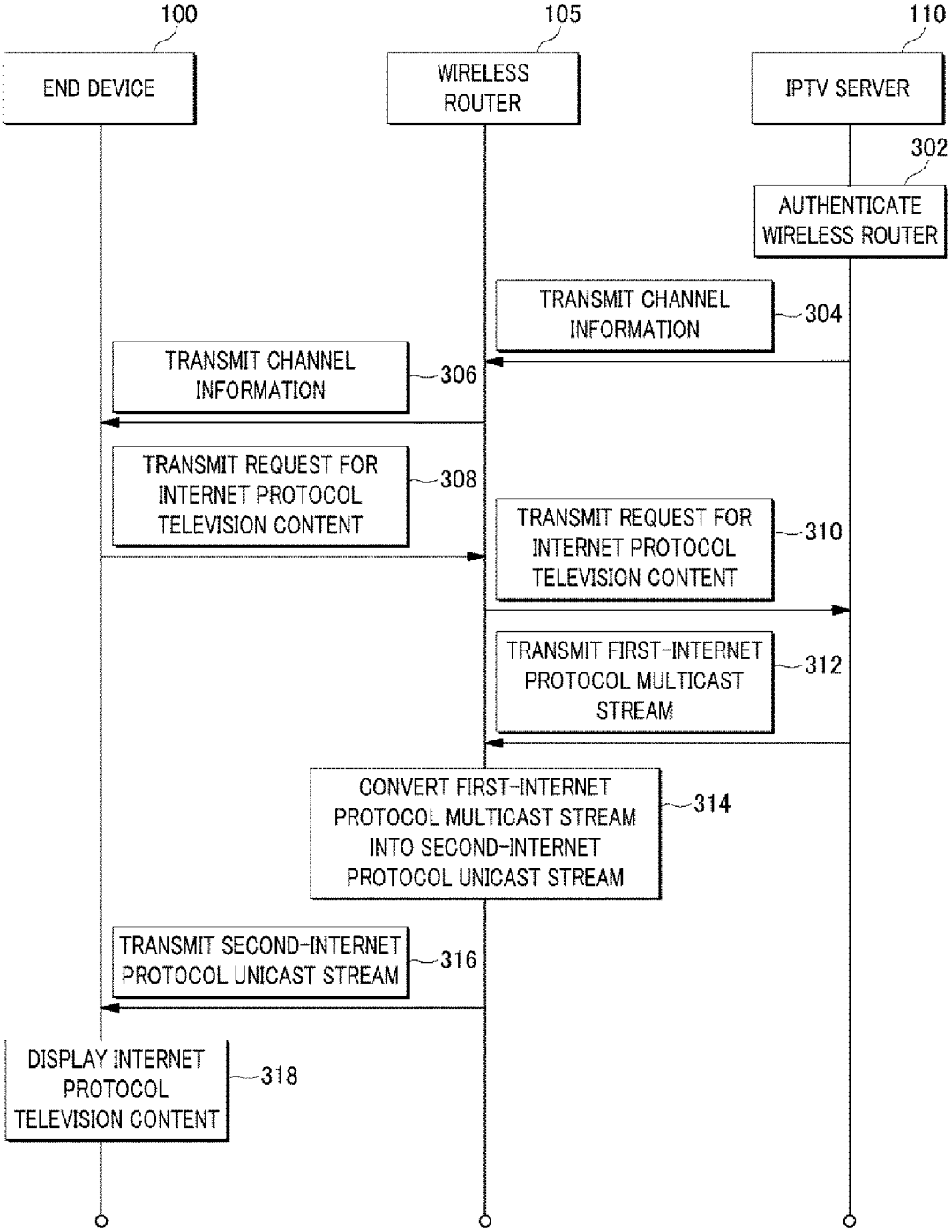

100
END DEVICE
105
WIRELESS ROUTER
110
IPTV SERVER
302
AUTHENTICATE WIRELESS ROUTER
TRANSMIT CHANNEL INFORMATION
304
TRANSMIT CHANNEL INFORMATION
306
TRANSMIT REQUEST FOR INTERNET PROTOCOL TELEVISION CONTENT
308
TRANSMIT REQUEST FOR INTERNET PROTOCOL TELEVISION CONTENT
310
TRANSMIT FIRST-INTERNET PROTOCOL MULTICAST STREAM
312
CONVERT FIRST-INTERNET PROTOCOL MULTICAST STREAM INTO SECOND-INTERNET PROTOCOL UNICAST STREAM
314
TRANSMIT SECOND-INTERNET PROTOCOL UNICAST STREAM
316
DISPLAY INTERNET PROTOCOL TELEVISION CONTENT
318

FIG. 4

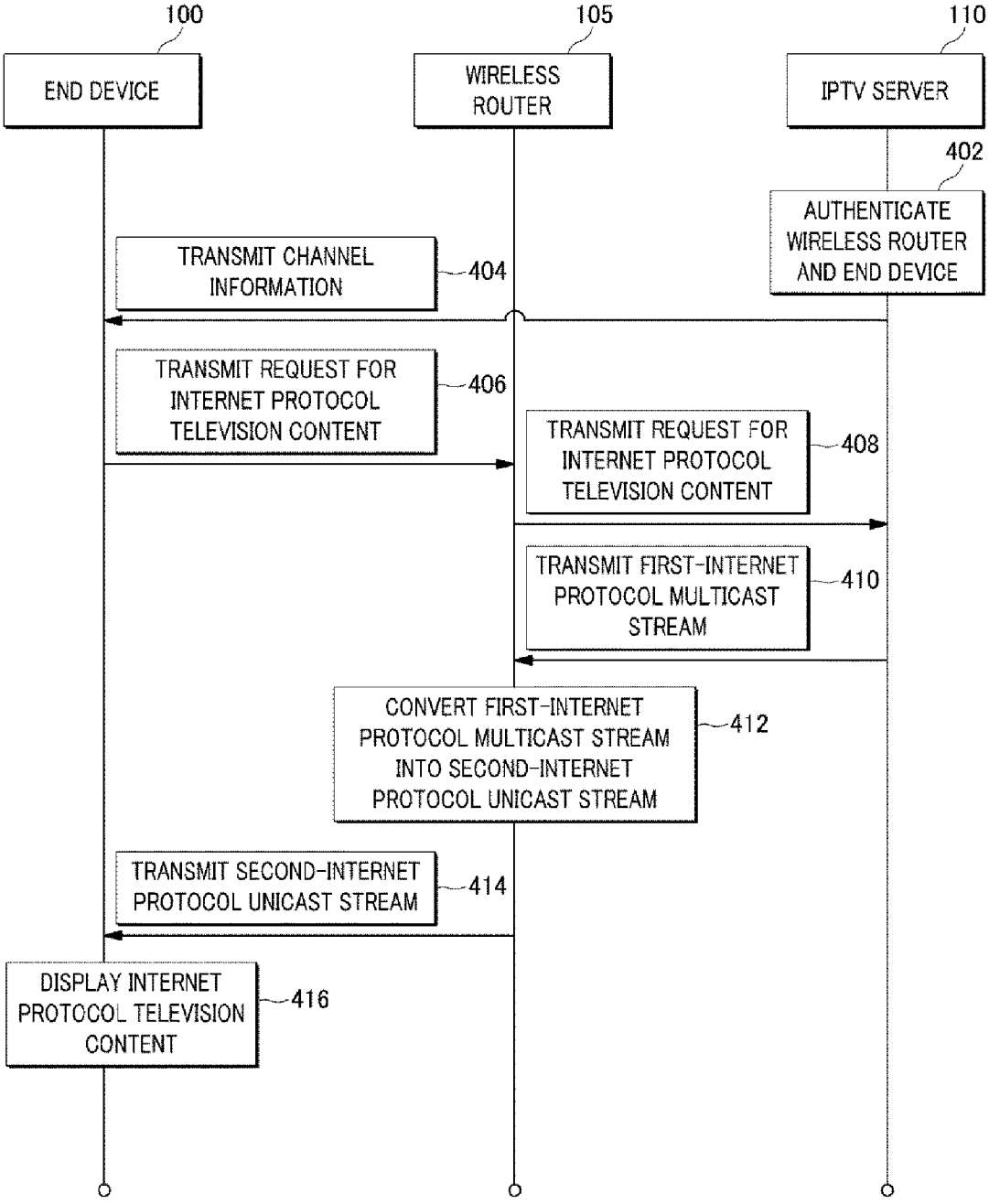

100
END DEVICE
105
WIRELESS ROUTER
110
IPTV SERVER
402
AUTHENTICATE WIRELESS ROUTER AND END DEVICE
TRANSMIT CHANNEL INFORMATION
404
TRANSMIT REQUEST FOR INTERNET PROTOCOL TELEVISION CONTENT
406
TRANSMIT REQUEST FOR INTERNET PROTOCOL TELEVISION CONTENT
408
TRANSMIT FIRST-INTERNET PROTOCOL MULTICAST STREAM
410
CONVERT FIRST-INTERNET PROTOCOL MULTICAST STREAM INTO SECOND-INTERNET PROTOCOL UNICAST STREAM
412
TRANSMIT SECOND-INTERNET PROTOCOL UNICAST STREAM
414
DISPLAY INTERNET PROTOCOL TELEVISION CONTENT
416

FIG. 5

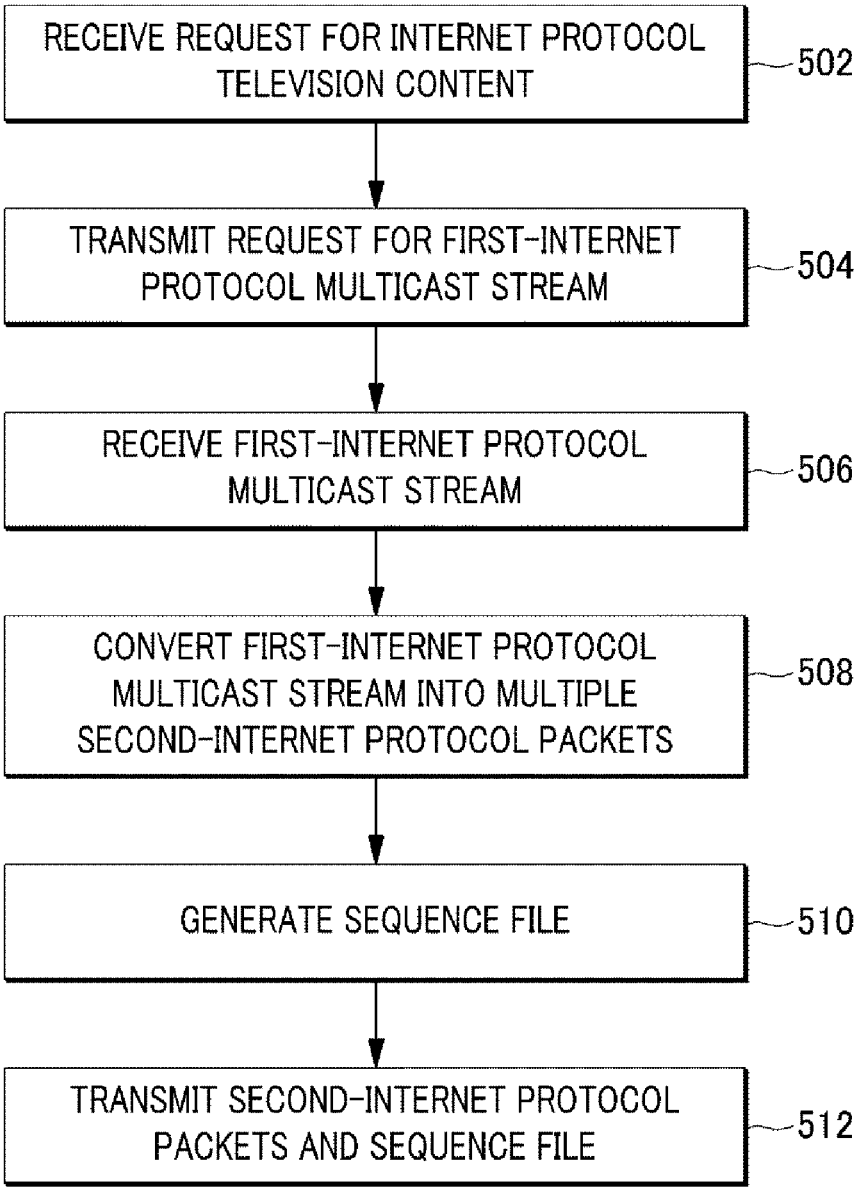
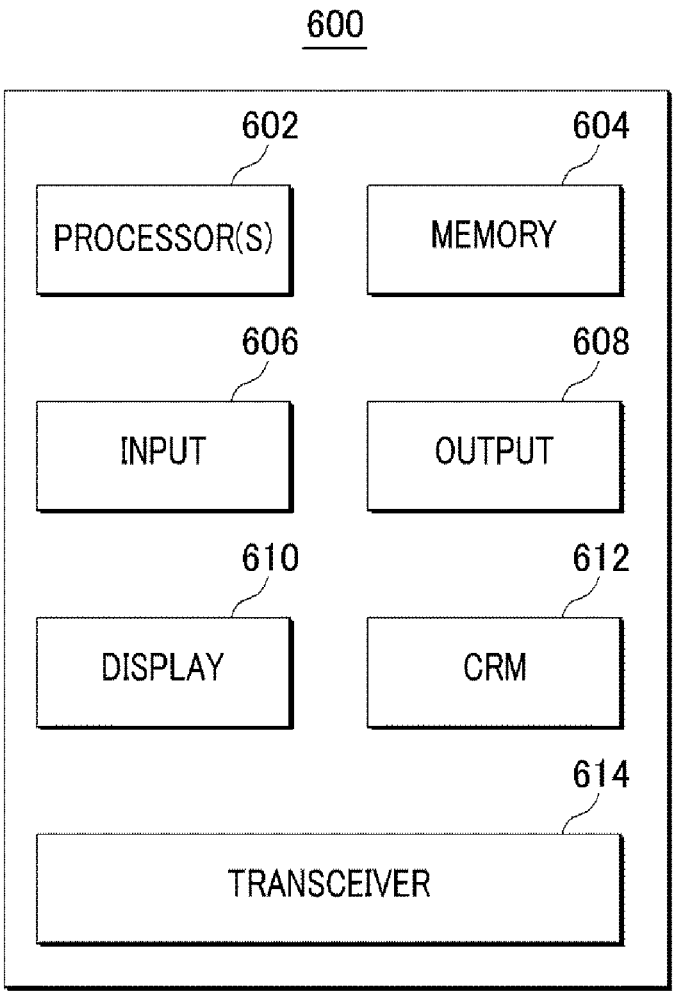

RECEIVE REQUEST FOR INTERNET PROTOCOL TELEVISION CONTENT
502
TRANSMIT REQUEST FOR FIRST-INTERNET PROTOCOL MULTICAST STREAM
504
RECEIVE FIRST-INTERNET PROTOCOL MULTICAST STREAM
506
CONVERT FIRST-INTERNET PROTOCOL MULTICAST STREAM INTO MULTIPLE SECOND-INTERNET PROTOCOL PACKETS
508
GENERATE SEQUENCE FILE
510
TRANSMIT SECOND-INTERNET PROTOCOL PACKETS AND SEQUENCE FILE
512

FIG. 6


600
602
PROCESSOR(S)
604
MEMORY
606
INPUT
608
OUTPUT
610
DISPLAY
612
CRM
614
TRANSCEIVER

CONTENT RELAYING SCHEME

TECHNICAL FIELD

The embodiments described herein pertain generally to schemes for relaying internet protocol television content.

BACKGROUND

An IPTV (Internet Protocol Television) service provider provides a service that integrates a security of a telecommunication network, content provided by a broadcast television network and features of the Internet; and provides voice, data, and video services over one connection simultaneously. Therefore, a user can not only make calls, access the Internet, and watch TV, but also enjoy more data, voice, and video integrated services through the IPTV service, serially or in parallel.

SUMMARY

In one example embodiment, a system includes an internet protocol television server configured to transmit a first-internet protocol multicast stream of internet protocol television content; a wireless router configured to: receive, from the internet protocol television server, the first-internet protocol multicast stream, convert the first-internet protocol multicast stream into a second-internet protocol unicast stream, and transmit the second-internet protocol unicast stream via a wireless network; and an end device configured to: transmit a request for the internet protocol television content to the wireless router, and receive the second-internet protocol unicast stream from the wireless router.

In another example embodiment, a wireless router includes a request receiving unit configured to receive a request for internet protocol television content from an end device that is authenticated by an internet protocol television server; a content receiving unit configured to receive, from the internet protocol television server, a first-internet protocol multicast stream; a protocol converting unit configured to convert the first-internet protocol multicast stream into a second-internet protocol unicast stream; and a transmitting unit configured to transmit the second-internet protocol unicast stream to the authenticated end device via a wireless network.

In yet another example embodiment, a method performed under control of a wireless router includes receiving a request for internet protocol television content from an end device that is authenticated by an internet protocol television server; receiving a first-internet protocol multicast stream of the requested internet protocol television content from the internet protocol television server; converting the first-internet protocol multicast stream into a second-internet protocol unicast stream; and transmitting the second-internet protocol unicast stream to the authenticated end device via a wireless network.

The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description that follows, embodiments are described as illustrations only since various changes and modifications will become apparent to those skilled in the art from the following detailed description. The use of the same reference numbers in different figures indicates similar or identical items.

FIG. **1** shows an example system configuration in which one or more embodiments of a content relaying scheme may be implemented;

FIG. **2** shows an example configuration of a wireless router by which at least portions of a content relaying scheme may be implemented;

FIG. **3** shows an example processing flow of operations by which at least portions of a content relaying scheme may be implemented;

FIG. **4** shows another example processing flow of operations by which at least portions of a content relaying scheme may be implemented;

FIG. **5** shows still another example processing flow of operations by which at least portions of a content relaying scheme may be implemented; and

FIG. **6** shows an illustrative computing embodiment, in which any of the processes and sub-processes of a content relaying scheme may be implemented as computer-readable instructions stored on a computer-readable medium.

DETAILED DESCRIPTION

In the following detailed description, reference is made to the accompanying drawings, which form a part of the description. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. Furthermore, unless otherwise noted, the description of each successive drawing may reference features from one or more of the previous drawings to provide clearer context and a more substantive explanation of the current example embodiment. Still, the example embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein and illustrated in the drawings, may be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are explicitly contemplated herein.

FIG. **1** shows an example system configuration in which one or more embodiments of a content relaying scheme may be implemented. As depicted in FIG. **1**, a system configuration **10** may include, at least, an end device **100**, a wireless router **105** and an internet protocol television (IPTV) server **110**. At least two or more of end device **100**, wireless router **105** and internet protocol television (IPTV) server **110** may be communicatively connected to each other via a network **115**.

By way of example, but not limitation, network **115**, which may be configured to communicatively couple one or more of end device **100**, wireless router **105** and IPTV server **110**, may be implemented in accordance with any wireless network protocol, such as a mobile radio communication network including at least one of a 3rd generation (3G) mobile telecommunications network, a 4th generation (4G) mobile telecommunications network, and any other mobile telecommunications networks, a satellite network, Bluetooth, WiBro (Wireless Broadband Internet), Mobile WiMAX, HSDPA (High Speed Downlink Packet Access) or the like.

End device **100** may refer to a notebook computer, a personal computer, a smart phone, a tablet device, a phablet device, a personal communication terminal, such as PCS (Personal Communication System), GMS (Global System for

Mobile communications), PDC (Personal Digital Cellular), PDA (Personal Digital Assistant), IMT (International Mobile Telecommunication)-2000, CDMA (Code Division Multiple Access)-2000, W-CDMA (W-Code Division Multiple Access) and Wibro (Wireless Broadband Internet) terminals.

Further, IPTV server **110** may refer to service providing organization or entity that provides real-time broadcasting services, video-on-demand (VOD) services, and/or user interactive services (e.g., a game) to end device **100**. IPTV server **110** may host one or more servers or other processing apparatuses that may be configured to provide IPTV content to multiple devices including end device **100**. Non-limiting examples of IPTV server **110** may include an Internet service provider (ISP); application service provider (ASP); storage service provider (SSP); and television service provider, i.e., cable TV, DSL and DBS. By way of example, but not limitation, the IPTV content may include real-time content or video on demand (VOD) content.

In some embodiments, IPTV server **110** may be configured to authenticate end device **100** based on authenticating information corresponding to end device **100**. By way of example, but not limitation, the authenticating information corresponding to end device **100** may include at least one of a media access control (MAC) address, an internet protocol (IP) address, a serial number, and/or a unique identifier. In some embodiments, IPTV server **110** may be configured to pre-register or store the authenticating information corresponding to end device **100** utilizing any one of various types of previous registration processes (e.g., log-in process or signing up for service membership) between end device **100** and IPTV server **110**. Further, IPTV server **110** may be configured to receive the authenticating information from end device **100**, and to compare the stored authenticating information and the received authenticating information.

Further, IPTV server **110** may be configured to authenticate wireless router **105** based on authenticating information corresponding to wireless router **105**. For example, the authenticating information corresponding to wireless router **105** may include at least one of a MAC address, an IP address, a serial number, and/or a unique identifier. In some embodiments, IPTV server **110** may be configured to pre-register or store the authenticating information corresponding to wireless router **105** utilizing any one of various types of previous registration processes between wireless router **105** and IPTV server **110**. Further, IPTV server **110** may be configured to receive the authenticating information from wireless router **105**, and to compare the stored authenticating information and the received authenticating information.

Further, in some embodiments, IPTV server **110** may be configured to transmit, to end device **100**, channel information that includes at least one of the IP address of IPTV server **110**, the port number of IPTV server **110**, or multiple channel identifiers of multiple content that IPTV server **110** provides to end device **100**.

In some other embodiments, IPTV server **110** may be configured to transmit the channel information to wireless router **105**, which, in turn, may be configured to transmit the received channel information to end device **100**.

End device **100** may be configured to transmit a request for IPTV content to wireless router **105**. By way of example, but not limitation, end device **100** may be configured to transmit the request to wireless router **105**, via information that includes an IP address of wireless router **105** and a port number of wireless router **105**. The information regarding the IP address and the port number of wireless router **105** may be provided to end device **100**, when end device **100** is coupled to wireless router **105** through network **115**. Further, the request for the IPTV content, which may be transmitted by end device **100**, may include the IP address of wireless router **105**, the port number of wireless router **105**, the IP address of IPTV server **110**, the port number of IPTV server **110**, and a channel identifier of the IPTV content.

Wireless router **105** may be configured to receive the request for the IPTV content from end device **100**. Further, wireless router **105** may be configured to transmit a request for the requested IPTV content to IPTV server **110**. In some embodiments, wireless router **105** may be configured to detect, from the request received from end device, the IP address of IPTV server **110**, the port number of IPTV server **110** and the channel identifier of the requested content. Wireless router **105** may be configured to then transmit, to IPTV server **110**, a request including the channel identifier of the requested content by using the detected IP address and port number of IPTV server **110**.

Wireless router **105** may be further configured to receive a first-internet protocol multicast stream of the IPTV content from IPTV server **110**. By way of example, but not limitation, the first-internet protocol multicast stream may include at least one of a user data protocol (UDT) broadcast stream or a real-time transport protocol (RTP) broadcast stream.

In some embodiments, wireless router **105** may be configured to detect the IP address and the port number of IPTV server **110** from the request received from end device **100**. Alternatively, wireless router **105** may be configured to detect the IP address and the port number of IPTV server **110** from the channel information, which may be received from IPTV server **110**. Wireless router **105** may be configured to receive the first-internet protocol multicast stream via an internet group management protocol (IGMP) implemented between wireless router **105** and IPTV server **110**, based on the detected IP address and port number of IPTV server **110**.

Further, wireless router **105** may be configured to convert the first-internet protocol multicast stream into a second-internet protocol unicast stream of the IPTV content. By way of example, but not limitation, the second-internet protocol unicast stream may include at least one of a transmission control protocol (TCP) broadcast stream or an http live streaming (HLS) broadcast stream.

In some embodiments, wireless router **105** may be configured to analyze a header layer of the first-internet protocol multicast stream, and to convert the first-internet protocol multicast stream into the second-internet protocol unicast stream based at least in part on header information that is written in the header layer. By way of example, but not limitation, the header information may include a sequence number of the first-internet protocol multicast stream and a time stamp value pertaining to an image frame encoding frequency of the IPTV content.

Wireless router **105** may be configured to divide the first-internet protocol multicast stream, and to convert the divided first-internet protocol multicast stream into multiple second-internet protocol packets based on the header information. Wireless router **105** may be further configured to generate a sequence file to inform end device **100** of a converted sequence of the multiple second-internet protocol packets. By way of example, the sequence file may include index information of each of the multiple second-internet protocol packets and sequence information of the multiple second-internet protocol packets. By way of example, but not limitation, the second-internet protocol packets may have a moving picture experts group-2 transport stream (MPEG-2 TS) format and the sequence file may have an M3U8 file format.

In some embodiments, wireless router **105** may be configured to update the sequence file in real-time or within a

predetermined time interval, when wireless router **105** completes converting the divided first-internet protocol multicast stream into the second-internet protocol packets.

Wireless router **105** may be further configured to transmit the second-internet protocol unicast stream to end device **100**, via network **115**. In some embodiments, wireless router **105** may be configured to transmit the multiple second-internet protocol packets and the sequence file to end device **100**. By way of example, but not limitation, the sequence file may include a uniform resource locator (URL) to be called for the purpose of the aforementioned transmission of the multiple second-internet protocol packets. End device **100** may be configured to obtain the URL from the sequence file, and call the URL to receive the multiple second-internet protocol packets based on user activation (i.e., a click) on the URL or automatically.

In some embodiments, wireless router **105** may be configured to analyze a payload type of the first-internet protocol multicast stream, which may include information regarding an encoding type of the first-internet protocol multicast stream. Wireless router **105** may be configured to transcode a first encoding type of the first-internet protocol multicast stream to a second encoding type. By way of example, but not limitation, the first encoding type may refer to an encoding type that is not decodable by end device **100**, such as an H.264 HIGH PROFILE video codec, an H.264 MAIN PROFILE video codec, an AC-3 audio codec, etc. Further, the second encoding type may refer to an encoding type that is decodable by end device **100**, such as an H.264 BASELINE PROFILE video codec, an AAC audio codec, etc.

Further, wireless router **105** may be configured to convert the first-internet protocol multicast stream, of which the first encoding type may be transcoded into the second encoding type, into the second-internet protocol unicast stream, and transmit the second-internet protocol unicast stream to end device **100**. End device **100** may be configured to receive the second-internet protocol unicast stream, which may be encoded by the second encoding type. End device **100** may be further configured to decode the second-internet protocol unicast stream, and display the IPTV content.

Thus, FIG. **1** shows an example system configuration **10** in which one or more embodiments of a content relaying scheme may be implemented.

FIG. **2** shows an example configuration of a wireless router by which at least portions of a content relaying scheme may be implemented. As depicted in FIG. **2**, wireless router **105** may include a request receiving unit **210**, a content receiving unit **220**, a protocol converting unit **230**, a transcoding unit **240**, a transmitting unit **250** and an authenticating unit **260**. Although illustrated as discrete components, various components may be divided into additional components, combined into fewer components, or eliminated altogether while being contemplated within the scope of the disclosed subject matter. It will be understood by those skilled in the art that each function and/or operation of the components may be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or virtually any combination thereof. In that regard, one or more of request receiving unit **210**, content receiving unit **220**, protocol converting unit **230**, transcoding unit **240**, transmitting unit **250** and authenticating unit **260** may be included in an instance of an application hosted on wireless router **105**.

Request receiving unit **210** may be configured to receive a request for IPTV content from end device **100**. In some embodiments, end device **100** may be previously authenticated by and coupled to wireless router **105** and IPTV server **110**. The received request for the IPTV content may include an IP address and a port number of wireless router **105**, an IP address and a port number of IPTV server **110** and a channel identifier of the requested IPTV content.

Content receiving unit **220** may be configured to receive, from IPTV server **110**, channel information that includes at least one of the IP address and the port number of IPTV server **110**, or multiple channel identifiers of multiple content that IPTV server **110** provides to end device **100**.

Further, content receiving unit **220** may be configured to transmit a request for the IPTV content, which is requested by end device **100**, to IPTV server **110**. In some embodiments, content receiving unit **220** may be configured to transmit a request for a first-internet protocol multicast stream of the IPTV content to IPTV server **110**. By way of example, but not limitation, the first-internet protocol multicast stream may include at least one of a UDT broadcast stream or a RTP broadcast stream.

Further, content receiving unit **220** may be configured to receive the IPTV content from IPTV server **110** in response to the request. In some embodiments, content receiving unit **220** may be configured to receive the first-internet protocol multicast stream of the IPTV content from IPTV server **110**. By way of example, content receiving unit **220** may be configured to detect the IP address and the port number of IPTV server **110** from the content request transmitted from end device **100**. Alternatively, content receiving unit **220** may be configured to detect the IP address and the port number of IPTV server **110** from the channel information, which may be transmitted from IPTV server **110**. Content receiving unit **220** may be configured to receive the first-internet protocol multicast stream via an IGMP implemented between wireless router **105** and IPTV server **110**, based on the detected IP address and port number of IPTV server **110**.

Protocol converting unit **230** may be configured to convert the first-internet protocol multicast stream into a second-internet protocol unicast stream of the IPTV content. By way of example, but not limitation, the second-internet protocol unicast stream may include at least one of a TCP broadcast stream or an HLS broadcast stream.

In some embodiments, protocol converting unit **230** may be configured to analyze a header layer of the first-internet protocol multicast stream, and to convert the first-internet protocol multicast stream into the second-internet protocol unicast stream based at least in part on header information that may be written in the header layer. By way of example, but not limitation, the header information may include a sequence number of the first-internet protocol multicast stream and a time stamp value pertaining to an image frame encoding frequency of the IPTV content. Protocol converting unit **230** may be configured to divide the first-internet protocol multicast stream, and to convert the first-internet protocol multicast stream into multiple second-internet protocol packets based on the header information. Protocol converting unit **230** may be further configured to generate a sequence file to inform end device **100** of a converted sequence of the multiple second-internet protocol packets. By way of example, but not limitation, the second-internet protocol packets may have a moving picture experts group-2 transport stream (MPEG-2 TS) format and the sequence file may have an M3U8 file format.

Further, protocol converting unit **230** may be configured to update the sequence file in real-time or with a predetermined time interval, when protocol converting unit **230** completes the converting of the first-internet protocol multicast stream into the second-internet protocol packets.

Transcoding unit **240** may be configured to analyze a payload type of the first-internet protocol multicast stream, which

includes information regarding an encoding type of the first-internet protocol multicast stream. Further, transcoding unit **240** may be configured to transcode a first encoding type of the first-internet protocol multicast stream to a second encoding type that may be decoded by end device **100** based on the payload type information. By way of example, but not limitation, the first encoding type may refer to an encoding type that is not decodable by end device **100**, such as an H.264 HIGH PROFILE video codec, an H.264 MAIN PROFILE video codec, an AC-3 audio codec, etc. Further, the second encoding type may refer to an encoding type that is decodable by end device **100**, such as an H.264 BASELINE PROFILE video codec, an AAC audio codec, etc.

Transmitting unit **250** may be configured to transmit the second-internet protocol unicast stream to end device **100**, which is authenticated by at least one of wireless router **105** or IPTV server **110**, via network **115**. In some embodiments, transmitting unit **250** may be configured to transmit the multiple second-internet protocol packets and the sequence file to end device **100**. By way of example, but not limitation, the sequence file may include a URL to be called for the purpose of transmission of the multiple second-internet protocol packets. End device **100** may obtain the URL from the sequence file and call the URL to receive the multiple second-internet protocol packets, based on user activation (i.e., a click) on the URL or automatically.

Further, transmitting unit **250** may be configured to transmit the channel information, which may be received by content receiving unit **220**, to end device **100**.

Authenticating unit **260** may be configured to transmit authenticating information of wireless router **105** to IPTV server **110**. By way of example, but not limitation, the authenticating information of wireless router **105** may include at least one of a MAC address of wireless router **105**, an IP address of wireless router **105**, a serial number assigned to wireless router **105**, or a unique identifier of wireless router **105**. IPTV server **110** may authenticate wireless router **105** based on the authenticating information, and transmit the first-internet protocol multicast stream to authenticated wireless router **105**.

Thus, FIG. **2** shows an example configuration of wireless router **105** by which at least portions of a content relaying scheme may be implemented.

FIG. **3** shows an example processing flow of operations by which at least portions of a content relaying scheme may be implemented. The operations in FIG. **3** may be implemented in system configuration **10** including end device **100**, wireless router **105** and IPTV server **110**, as illustrated in FIG. **1**. An example process may include one or more operations, actions, or functions as illustrated by one or more blocks **302**, **304**, **306**, **308**, **310**, **312**, **314**, **316** and/or **318**. Although illustrated as discrete blocks, various blocks may be divided into additional blocks, combined into fewer blocks, or eliminated, depending on the desired implementation. Processing may begin at block **302**.

Block **302** (Authenticate Wireless Router) may refer to IPTV server **110** authenticating wireless router **105**. In some embodiments, wireless router **105** may transmit authenticating information of wireless router **105** to IPTV server **110**. Further, IPTV server **110** may receive the authenticating information, and authenticate wireless router **105** based on the received authenticating information. By way of example, but not limitation, IPTV server **110** may pre-register or store the authenticating information of wireless router **105** using one of various types of pre-registration processes, and compare the stored authenticating information and the received authenticating information. Processing may proceed from block **302** to block **304**.

Block **304** (Transmit Channel Information) may refer to IPTV server **110** transmitting channel information to wireless router **105**, which may be authenticated at block **302**. By way of example, but not limitation, the channel information may include at least one of an IP address of IPTV server **110**, a port number of IPTV server **110**, or multiple channel identifiers of multiple content that IPTV server **110** provides to end device **100**. Processing may proceed from block **304** to block **306**.

Block **306** (Transmit Channel Information) may refer to wireless router **105** transmitting, to end device **100**, the channel information which may be transmitted from IPTV server **110** at block **304**. Processing may proceed from block **306** to block **308**.

Block **308** (Transmit Request for Internet Protocol Television Content) may refer to end device **100** transmitting a request for IPTV content to wireless router **105**, using information including an IP address of wireless router **105** and a port number of wireless router **105**. By way of example, end device **100** may search for and detect the information regarding the IP address and the port number of wireless router **105**, when end device **100** is coupled to wireless router **105**. Alternatively, a user of end device **100** may already have the information regarding the IP address and the port number of wireless router **105** in advance, before end device **100** is coupled to wireless router **105**. Further, the request for the IPTV content may include the IP address and the port number of wireless router **105**, the IP address and the port number of IPTV server **110** and a channel identifier of the IPTV content. Processing may proceed from block **308** to block **310**.

Block **310** (Transmit Request for Internet Protocol Television Content) may refer to wireless router **105** transmitting a request for the IPTV content, which may be requested by end device **100** at block **308**, to IPTV server **110**. In some embodiments, wireless router **105** may detect the IP address of IPTV server **110**, the port number of IPTV server **110** and the channel identifier of the requested content from the request, which may be transmitted from end device **100** at block **308**. Then, wireless router **105** may transmit, to IPTV server **110**, a request that includes the channel identifier of the requested content by using the detected IP address and port number of IPTV server **110**. Processing may proceed from block **310** to block **312**.

Block **312** (Transmit First-Internet Protocol Multicast Stream) may refer to IPTV server **110** transmitting a first-internet protocol multicast stream of the IPTV content to wireless router **105**. By way of example, but not limitation, the first-internet protocol multicast stream may include at least one of a UDT broadcast stream or a RTP broadcast stream. In some embodiments, wireless router **105** may receive the first-internet protocol multicast stream via an IGMP implemented between wireless router **105** and IPTV server **110**, based on the IP address and the port number of IPTV server **110**. Processing may proceed from block **312** to block **314**.

Block **314** (Convert First-Internet Protocol Multicast Stream into Second-Internet Protocol Unicast Stream) may refer to wireless router **105** converting the first-internet protocol multicast stream into a second-internet protocol unicast stream. By way of example, but not limitation, the second-internet protocol unicast stream may include at least one of a TCP broadcast stream or an HLS broadcast stream.

In some embodiments, wireless router **105** may divide the first-internet protocol multicast stream, and convert the first-internet protocol multicast stream into multiple second-inter-

net protocol packets. Further, wireless router **105** may generate a sequence file to inform end device **100** of a converted sequence of the multiple second-internet protocol packets. By way of example, but not limitation, the second-internet protocol packets may have a moving picture experts group-2 transport stream (MPEG-2 TS) format and the sequence file may have an M3U8 file format. Processing may proceed from block **314** to block **316**.

Block **316** (Transmit Second-Internet Protocol Unicast Stream) may refer to wireless router **105** transmitting the second-internet protocol unicast stream to end device **100**. In some embodiments, wireless router **105** may transmit the multiple second-internet protocol packets and the sequence file, which are generated at block **314**, to end device **100**. By way of example, but not limitation, the sequence file may include a URL to be called for the purpose of downloading the multiple second-internet protocol packets. Processing may proceed from block **316** to block **318**.

Block **318** (Display Internet Protocol Television Content) may refer to end device **100** displaying the IPTV content. End device **100** may receive the second-internet protocol unicast stream of the IPTV content. By way of example, end device **100** may receive the sequence file, and obtain the URL from the sequence file. Then, end device **100** may call the URL to receive the multiple second-internet protocol packets. End device **100** may decode the multiple second-internet protocol packets and display the IPTV content.

Thus, FIG. **3** shows an example processing flow of operations by which at least portions of a content relaying scheme may be implemented.

FIG. **4** shows another example processing flow of operations by which at least portions of a content relaying scheme may be implemented. The operations in FIG. **4** may be implemented in system configuration **10** including end device **100**, wireless router **105** and IPTV server **110**, as illustrated in FIG. **1**. An example process may include one or more operations, actions, or functions as illustrated by one or more blocks **402**, **404**, **406**, **408**, **410**, **412**, **414** and/or **416**. Although illustrated as discrete blocks, various blocks may be divided into additional blocks, combined into fewer blocks, or eliminated, depending on the desired implementation. Processing may begin at block **402**.

Block **402** (Authenticate Wireless Router and End Device) may refer to IPTV server **110** authenticating wireless router **105** and end device **100**. In some embodiments, wireless router **105** may transmit authenticating information corresponding to wireless router **105** to IPTV server **110**. Further, end device **100** may transmit authenticating information corresponding to end device **100** to IPTV server **110**. Further, IPTV server **110** may authenticate wireless router **105** based on the authenticating information corresponding to wireless router **105**, and authenticate end device **100** based on the authenticating information of end device **100**. By way of example, but not limitation, the authenticating information corresponding to wireless router **105** or end device **100** may include at least one of a MAC address of wireless router **105** or end device **100**, an IP address of wireless router **105** or end device **100**, a serial number assigned to wireless router **105** or end device **100**, or a unique identifier of wireless router **105** or end device **100**. Processing may proceed from block **402** to block **404**.

Block **404** (Transmit Channel Information) may refer to IPTV server **110** transmitting channel information to end device **100**, which may be authenticated at block **402**. By way of example, but not limitation, the channel information may include at least one of an IP address of IPTV server **110**, a port number of IPTV server **110**, or multiple channel identifiers of multiple content that IPTV server **110** provides to end device **100**. Processing may proceed from block **404** to block **406**.

Block **406** (Transmit Request for Internet Protocol Television Content) may refer to end device **100** transmitting a request for IPTV content to wireless router **105**, using information including an IP address of wireless router **105** and a port number of wireless router **105**. By way of example, end device **100** may search for and detect the information regarding the IP address and the port number of wireless router **105**, when end device **100** is coupled to wireless router **105**. Alternatively, a user of end device **100** may already have the information regarding the IP address and the port number of wireless router **105** in advance, before end device **100** is coupled to wireless router **105**. Further, the request for the IPTV content may include the IP address and the port number of wireless router **105**, the IP address and the port number of IPTV server **110** and a channel identifier of the IPTV content. Processing may proceed from block **406** to block **408**.

Block **408** (Transmit Request for Internet Protocol Television Content) may refer to wireless router **105** transmitting a request for the IPTV content to IPTV server **110**. In some embodiments, wireless router **105** may detect the IP address of IPTV server **110**, the port number of IPTV server **110** and the channel identifier of the requested IPTV content from the request, which may be transmitted from end device **100** at block **406**. Then, wireless router **105** may transmit, to IPTV server **110**, a request that includes the channel identifier of the requested IPTV content by using the detected IP address and port number of IPTV server **110**. Processing may proceed from block **408** to block **410**.

Block **410** (Transmit First-Internet Protocol Multicast Stream) may refer to IPTV server **110** transmitting a first-internet protocol multicast stream of the IPTV content to wireless router **105**. By way of example, but not limitation, the first-internet protocol multicast stream may include at least one of a UDT broadcast stream or a RTP broadcast stream. In some embodiments, wireless router **105** may receive the first-internet protocol multicast stream via an IGMP implemented between wireless router **105** and IPTV server **110**, based on the IP address and the port number of IPTV server **110**. Processing may proceed from block **410** to block **412**.

Block **412** (Convert First-Internet Protocol Multicast Stream into Second Internet Protocol Unicast Stream) may refer to wireless router **105** converting the first-internet protocol multicast stream into a second-internet protocol unicast stream. By way of example, but not limitation, the second-internet protocol unicast stream may include at least one of a TCP broadcast stream or an HLS broadcast stream.

In some embodiments, wireless router **105** may divide the first-internet protocol multicast stream, and convert the first-internet protocol multicast stream into multiple second-internet protocol packets. Further, wireless router **105** may generate a sequence file to inform end device **100** of a converted sequence of the multiple second-internet protocol packets. By way of example, but not limitation, the second-internet protocol packets may have a moving picture experts group-2 transport stream (MPEG-2 TS) format and the sequence file may have an M3U8 file format. Processing may proceed from block **412** to block **414**.

Block **414** (Transmit Second-Internet Protocol Unicast Stream) may refer to wireless router **105** transmitting the second-internet protocol unicast stream to end device **100**. In some embodiments, wireless router **105** may transmit the multiple second-internet protocol packets and the sequence file, which are generated at block **412**, to end device **100**. By way of example, but not limitation, the sequence file may

include a URL to be called for the purpose of downloading the multiple second-internet protocol packets. Processing may proceed from block **414** to block **416**.

Block **416** (Display Internet Protocol Television Content) may refer to end device **100** displaying the IPTV content. End device **100** may receive the second-internet protocol unicast stream of the IPTV content. By way of example, end device **100** may receive the sequence file, and obtain the URL from the sequence file. Then, end device **100** may call the URL to receive the multiple second-internet protocol packets. End device **100** may decode the multiple second-internet protocol packets and display the IPTV content.

Thus, FIG. **4** shows another example processing flow of operations by which at least portions of a content relaying scheme may be implemented.

FIG. **5** shows still another example processing flow of operations by which at least portions of a content relaying scheme may be implemented. The operations in FIG. **5** may be implemented in wireless router **105** including request receiving unit **210**, content receiving unit **220**, protocol converting unit **230**, transcoding unit **240**, transmitting unit **250** and authenticating unit **260**, as illustrated in FIG. **2**. An example process may include one or more operations, actions, or functions as illustrated by one or more blocks **502**, **504**, **506**, **508**, **510** and/or **512**. Although illustrated as discrete blocks, various blocks may be divided into additional blocks, combined into fewer blocks, or eliminated, depending on the desired implementation. Processing may begin at block **502**.

At block **502** (Receive Request for Internet Protocol Television Content) may refer to request receiving unit **210** receiving a request for IPTV content from end device **100**. By way of example, the received request for the IPTV content may include an IP address and a port number of wireless router **105**, an IP address and a port number of IPTV server **110** and a channel identifier of the requested IPTV content. Processing may proceed from block **502** to block **504**.

At block **504** (Transmit Request for First-Internet Protocol Multicast Stream) may refer to content receiving unit **220** transmitting a request for a first-internet protocol multicast stream of the IPTV content, which may be requested by end device **100** at block **502**, to IPTV server **110**. By way of example, content receiving unit **220** may transmit, to IPTV server **110**, a request that includes the channel identifier of the requested IPTV content by using the IP address and the port number of IPTV server **110**. Processing may proceed from block **504** to block **506**.

At block **506** (Receive First-Internet Protocol Multicast Stream) may refer to content receiving unit **220** receiving the first-internet protocol multicast stream from IPTV server **110**. By way of example, but not limitation, the first-internet protocol multicast stream may include at least one of a UDT broadcast stream or a RTP broadcast stream. Processing may proceed from block **506** to block **508**.

At block **508** (Convert First-Internet Protocol Multicast Stream into Multiple Second-Internet Protocol Packets) may refer to protocol converting unit **230** converting the first-internet protocol multicast stream into a second-internet protocol unicast stream. By way of example, but not limitation, the second-internet protocol unicast stream may include at least one of a TCP broadcast stream or an HLS broadcast stream. In some embodiments, protocol converting unit **230** may divide the first-internet protocol multicast stream, and convert the first-internet protocol multicast stream into multiple second-internet protocol packets. By way of example, but not limitation, the second-internet protocol packets may have a moving picture experts group-2 transport stream (MPEG-2 TS) format. Processing may proceed from block **508** to block **510**.

At block **510** (Generate Sequence File) may refer to protocol converting unit **230** generating a sequence file to inform end device **100** of a converted sequence of the multiple second-internet protocol packets. By way of example, the sequence file may include index information of each of the multiple second-internet protocol packets and sequence information of the multiple second-internet protocol packets. In some embodiments, protocol converting unit **230** may update the sequence file in real-time or within a predetermined time interval, when protocol converting unit **230** completes converting the first-internet protocol multicast stream into the second-internet protocol packets. By way of example, but not limitation, the sequence file may have an M3U8 file format. Processing may proceed from block **510** to block **512**.

At block **512** (Transmit Second-Internet Protocol Packets and Sequence File) may refer to transmitting unit **250** transmitting the multiple second-internet protocol packets and the sequence file to end device **100**. Then, frames or content corresponding to the transmitted multiple second-internet protocol packets may be displayed on end device **100**, and the sequence file may be stored in a predefined location (e.g., folders) on end device **100**.

Thus, FIG. **5** shows still another example processing flow of operations by which at least portions of a content relaying scheme may be implemented.

One skilled in the art will appreciate that, for this and other processes and methods disclosed herein, the functions performed in the processes and methods may be implemented in differing order. Furthermore, the outlined steps and operations are only provided as examples, and some of the steps and operations may be optional, combined into fewer steps and operations, or expanded into additional steps and operations without detracting from the essence of the disclosed embodiments.

FIG. **6** shows an illustrative computing embodiment, in which any of the processes and sub-processes of a content relaying scheme may be implemented as computer-readable instructions stored on a computer-readable medium. The computer-readable instructions may, for example, be executed by a processor of a device, as referenced herein, having a network element and/or any other device corresponding thereto, particularly as applicable to the applications and/or programs described above corresponding to the configuration **10** for transactional permissions.

In a very basic configuration, a computing device **600** may typically include, at least, one or more processors **602**, a system memory **604**, one or more input components **606**, one or more output components **608**, a display component **610**, a computer-readable medium **612**, and a transceiver **614**.

Processor **602** may refer to, e.g., a microprocessor, a microcontroller, a digital signal processor, or any combination thereof.

Memory **604** may refer to, e.g., a volatile memory, non-volatile memory, or any combination thereof. Memory **604** may store, therein, an operating system, an application, and/or program data. That is, memory **604** may store executable instructions to implement any of the functions or operations described above and, therefore, memory **604** may be regarded as a computer-readable medium.

Input component **606** may refer to a built-in or communicatively coupled keyboard, touch screen, or telecommunication device. Alternatively, input component **606** may include a microphone that is configured, in cooperation with a voice-recognition program that may be stored in memory **604**, to

receive voice commands from a user of computing device **600**. Further, input component **606**, if not built-in to computing device **600**, may be communicatively coupled thereto via short-range communication protocols including, but not limitation, radio frequency or Bluetooth.

Output component **608** may refer to a component or module, built-in or removable from computing device **600**, that is configured to output commands and data to an external device.

Display component **610** may refer to, e.g., a solid state display that may have touch input capabilities. That is, display component **610** may include capabilities that may be shared with or replace those of input component **606**.

Computer-readable medium **612** may refer to a separable machine readable medium that is configured to store one or more programs that embody any of the functions or operations described above. That is, computer-readable medium **612**, which may be received into or otherwise connected to a drive component of computing device **600**, may store executable instructions to implement any of the functions or operations described above. These instructions may be complimentary or otherwise independent of those stored by memory **604**.

Transceiver **614** may refer to a network communication link for computing device **600**, configured as a wired network or direct-wired connection. Alternatively, transceiver **614** may be configured as a wireless connection, e.g., radio frequency (RF), infrared, Bluetooth, and other wireless protocols.

From the foregoing, it will be appreciated that various embodiments of the present disclosure have been described herein for purposes of illustration, and that various modifications may be made without departing from the scope and spirit of the present disclosure. Accordingly, the various embodiments disclosed herein are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

We claim:

1. A system, comprising:

an internet protocol television server configured to:

receive authenticating information from a wireless router;

compare stored authenticating information with the received authenticating information;

authenticate the wireless router based at least in part on authenticating information of the wireless router, wherein the authenticating information of the wireless router includes a unique identifier of the wireless router,

authenticate an end device based at least in part on authenticating information of the end device, wherein the authenticating information of the end device includes a unique identifier of the end device, and

transmit a first-internet protocol multicast stream of internet protocol television content; the wireless router configured to:

analyze a header layer of the first-internet protocol multicast stream, wherein the header information includes at least one of a sequence number of the first-internet protocol multicast stream or a time stamp value pertaining to an image frame encoding frequency of the IPTV content;

receive, from the internet protocol television server, the first-internet protocol multicast stream,

wherein the first-internet protocol multicast stream includes at least one of a UDT broadcast stream or a RTP broadcast stream;

convert the first-internet protocol multicast stream into a second-internet protocol unicast stream, and

transmit the second-internet protocol unicast stream via a wireless network; and an end device configured to:

transmit a request for the internet protocol television content to the wireless router, and receive the second-internet protocol unicast stream from the wireless router;

wherein the second-internet protocol unicast stream includes at least one of a TCP broadcast stream or an HLS broadcast stream.

2. The system of claim **1**, wherein the wireless router is further configured to:

convert the first-internet protocol multicast stream into a plurality of second-internet protocol packets;

generate a sequence file to inform the end device of a converted sequence of the plurality of second-internet protocol packets; and

transmit the sequence file to the end device.

3. The system of claim **1**, wherein the internet protocol television server is further configured to transmit, to the end device, channel information that includes at least one of an internet protocol address, a port number or a channel identifier,

wherein the request for the internet protocol television content from the end device includes the channel information, and

wherein the wireless router is further configured to transmit a request for the first-internet protocol multicast stream to the internet protocol television server based at least in part on the received channel information.

4. The system of claim **1**, wherein the internet protocol television server is further configured to transmit, to the wireless router, channel information that includes at least one of an internet protocol address, a port number or a channel identifier, and

wherein the wireless router is further configured to transmit a request for the first-internet protocol multicast stream to the internet protocol television server based at least in part on the channel information.

5. The system of claim **1**, wherein the wireless router is further configured to transcode a first encoding type of the first-internet protocol multicast stream to a second encoding type to be decoded by the end device.

6. A method performed under control of a wireless router, comprising: receiving authenticating information from the wireless router;

compare stored authenticating information with the received authenticating information;

authenticating the wireless router with an internet protocol television server using authenticating information of the wireless router, wherein the authenticating information of the wireless router includes a unique identifier of the wireless router;

receiving a request for internet protocol television content from an end device that is authenticated by the internet protocol television server, wherein the end device is authenticated using authenticating information of the end device and the authenticating information of the end device includes a unique identifier of the end device;

receiving a first-internet protocol multicast stream of the requested internet protocol television content from the internet protocol television server;

analyzing a header layer of the first-internet protocol multicast stream, wherein the header information includes at least one of a sequence number of the first-internet protocol multicast stream or a time stamp value pertaining to an image frame encoding frequency of the IPTV content;

wherein the first-internet protocol multicast stream includes at least one of a UDT broadcast stream or a RTP broadcast stream;

converting the first-internet protocol multicast stream into a second-internet protocol unicast stream; and

transmitting the second-internet protocol unicast stream to the authenticated end device via a wireless network.

7. The method of claim **6**, wherein the converting of the first-internet protocol multicast stream includes:

converting the first-internet protocol based multicast stream into a plurality of second-internet protocol packets; and

generating a sequence file to inform the end device of a converted sequence of the plurality of second-internet protocol packets, and

wherein the transmitting of the second-internet protocol based unicast stream includes transmitting the sequence file.

8. The method of claim **7**, further comprising:

updating the sequence file.

9. The method of claim **7**, further comprising:

transmitting authenticating information of the wireless router to the internet protocol television server,

wherein the first-internet protocol multicast stream is received from the internet protocol television server when the wireless router is authenticated.

10. The method of claim **6**,

wherein the received request for the internet protocol television content includes at least one of an internet protocol address, a port number or a channel identifier, and

the method further comprises transmitting of a request for the first-internet protocol multicast stream.

11. The method of claim **6**, further comprising:

transcoding a first encoding type of the first-internet protocol multicast stream to a second encoding type to be decoded by the end device.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,237,382 B2
APPLICATION NO. : 14/067258
DATED : January 12, 2016
INVENTOR(S) : Jong-heum Kim et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claims

Column 13, line 39 through Column 14, line 8, Claim 1

-- 1. (**Currently Amended**) A system, comprising:

an internet protocol television server configured to:

receive authenticating information from a wireless router,

compare stored authenticating information with the received authenticating information,

authenticate the wireless router based at least in part on authenticating information of the wireless router, wherein the authenticating information of the wireless router includes a unique identifier of the wireless router,

authenticate an end device based at least in part on authenticating information of the end device, wherein the authenticating information of the end device includes a unique identifier of the end device, and

transmit a first-internet protocol multicast stream of internet protocol television content;

the wireless router configured to:

analyze a header layer of the first-internet protocol multicast stream, wherein the header information includes at least one of a sequence number of the first internet protocol multicast stream or a time stamp value pertaining to an image frame encoding frequency of the IPTV content;

receive, from the internet protocol television server, the first-internet protocol multicast stream,

Signed and Sealed this
Twelfth Day of April, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office

wherein the first internet protocol multicast stream includes at least one of a UDT broadcast stream or a RTP broadcast stream;

convert the first-internet protocol multicast stream into a second-internet protocol unicast stream, and

transmit the second-internet protocol unicast stream via a wireless network; and

an end device configured to:

transmit a request for the internet protocol television content to the wireless router, and

receive the second-internet protocol unicast stream from the wireless router. --.

Column 14, delete lines 6-8

"wherein the second internet protocol unicast stream includes at least one of a TCP broadcast stream or an HLS broadcast stream".